Prognosis of patients undergoing emergency surgery for type A acute aortic dissection without exclusion of the intimal tear

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Objectives: To investigate the prognosis after emergency surgery for acute type A aortic dissection with an unknown entry site and to identify the predictors of postoperative aortic dilatation.

Methods: The subjects were 102 patients undergoing emergency surgery for acute type A dissection from July 2005 to October 2010. They were divided into group I (n = 45) undergoing aortic surgery without tear resection and group II (n = 57) undergoing resection that included the intimal tear.

Results: The postoperative hospital mortality was similar, 13.3% (n = 6) in group I and 12.3% (n = 7) in group II. Of the 102 patients, 69 underwent follow-up computed tomography scanning after discharge, and the aortic diameter was significantly increased in group I compared with that in group II ($P = .035$). Dilatation of the descending aorta occurred in 21 patients (30.4%). Multivariate logistic regression analysis revealed that a patent false lumen ($P = .027$) and nonexclusion of the entry site ($P = .012$) were independent risk factors for aortic dilatation. No difference was found in the freedom from aorta-related clinical events at 4 years, with a rate of 81.9% in group I and 74.4% in group II. Also, no difference was found in the 4-year actuarial survival rate between groups I and II (86.4% and 78.5%, respectively).

Conclusions: The prognosis of patients without exclusion of the entry site was acceptable. Careful follow-up is needed for patients with a patent false lumen or nonexcluded entry because of the risk of aortic dilatation. (J Thorac Cardiovasc Surg 2013;146:67-71)

The management of acute type A aortic dissection (AAAD) is problematic, and it is still unclear how extensive the aortic resection should be for patients with this life-threatening condition. Our fundamental strategy for AAAD involves excision of the intimal tear. In most patients, ascending aortic or proximal arch replacement is sufficient because the intimal tear is generally located in the concavity of the transverse part of the arch.[1] When the tear is located in the aortic arch, however, total arch replacement should be performed to achieve tear excision. If the intimal tear is not identified anywhere from the ascending aorta to the distal arch, our treatment strategy has been to simply replace the proximal arch and conduct careful follow-up after surgery. However, a risk exists of the residual aorta expanding because the intimal tear has not been resected. In the present study, we reviewed the data from patients undergoing aortic resection for AAAD without tear excision and assessed their medium-term outcomes.

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METHODS

From July 2005 to October 2010, 116 patients with AAAD underwent emergency surgery at our institutions. Contrast computed tomography (CT) was performed in all patients as soon as they were referred to the hospital. This was followed by transthoracic echocardiography to detect pericardial effusion and to assess for aortic regurgitation and cardiac function. Even if the initial CT scan revealed a thrombosed false lumen, we recommended emergency surgery. Patients were transferred to the operating room as soon as possible after informed consent to surgery was obtained. Of the 116 patients, 7 who had undergone total arch replacement and 7 with Debakey type II aortic dissection were excluded from the present study.

In 45 patients, the intimal tear was not located anywhere from the ascending aorta to the distal arch; thus, aortic resection did not include the tear (group I). The remaining 57 patients, with the entry site located in the ascending aorta or proximal aortic arch, underwent resection that included the tear and ascending aortic or hemiarch replacement (group II).

The institutional review board approved the reporting of the information obtained from our retrospective study.

Surgical Procedure

We previously reported the surgical technique.[2-5] Cardiopulmonary bypass was implemented after cannulation of the femoral artery. A 2-stage venous cannula was inserted into the right atrium. The ascending aorta was then opened longitudinally under moderate hypothermic arrest (28°C) without cerebral perfusion. Replacement of the ascending aorta or hemiarch replacement was performed with a Dacron graft after both the distal and the proximal stumps of the aorta were reinforced with Teflon felt and gelatin resorcin formalin glue. Antegrade systemic circulation was re-established through a side branch of the graft after completion of the open distal anastomosis.

CT Follow-up

Enhanced CT scanning was performed at our outpatient clinic 1 month after surgery, and CT was repeated annually thereafter. The maximum

Abbreviations and Acronyms
AAAD = acute type A aortic dissection
CT = computed tomography

diameter of the residual thoracic aorta and the patency of the false lumen were assessed on the CT scans. On the final scan, the aortic diameter was measured at the level at which it was largest on the first postoperative scan. An aortic diameter of 60 mm or larger was defined as an aneurysmal change. Dilatation of the descending aorta was defined as an increase in the maximal diameter by 5 mm or more during the follow-up period. Aorta-related clinical events were defined as aneurysmal change, reoperation, and death.

Operative mortality was defined as any death within 30 days after surgery in or outside the hospital. In-hospital mortality was defined as any death that occurred before discharge from our hospital or another hospital to which the patient had been transferred.

Statistical Analysis

Continuous variables are reported as the mean ± standard deviation. For comparison of the 2 groups, Student *t* test was used for continuous variables and the chi-square test for categorical variables. For multivariate analysis, only variables with $P < .01$ on univariate analysis were entered into the logistic regression model. The Kaplan-Meier method was used to determine the survival rate and the freedom from aorta-related clinical event rate. Statistical analyses were performed using SPSS software, version 11 (SPSS, Chicago, Ill).

RESULTS

The clinical profile and dissection characteristics of the 2 groups are listed in Table 1. Compared with group I, group II had significantly greater rates of moderate to severe aortic regurgitation ($P = .016$) and a patent false lumen in the ascending aorta ($P = .015$). Group II patients were also significantly older than those in group I (Table 1). The average duration of cardiopulmonary bypass, aortic crossclamp time, and circulatory arrest time were all significantly shorter in group I than in group II. A modified Bentall procedure was performed in 3 patients with severe aortic regurgitation because of marked dilatation of the aortic root. One patient underwent separate aortic valve replacement for a bicuspid valve. No differences were found in the incidence of postoperative neurologic deficits, pneumonia, deep sternal wound infection, or renal failure between the 2 groups. The postoperative hospital mortality was also similar at 13.3% (6 patients) in group I and 12.3% (7 patients) in group II (Table 2).

Of the 89 survivors, 2 died within 5 months after discharge from the hospital of cerebral infarction and rupture of the thoracic aortic aneurysm, respectively. Eight of the survivors did not undergo enhanced CT scanning owing to renal insufficiency, contrast medium allergy, or other reasons. Ten survivors were referred to other hospitals for ongoing treatment. Sixty-nine patients underwent follow-up CT scanning after discharge. The interval between surgery and the final CT scan was 12 to 59 months (mean, 33.0 ± 13.4). On the initial postoperative CT scans, the incidence of a patent false lumen and the aortic diameter was similar in the 2 groups. However, the extent of aortic dilatation over time was significantly greater in group I than in group II (Table 3).

Dilatation of the descending aorta occurred in 21 patients (30.4%), and the site of dilatation was the distal arch in 12. Multivariate analysis revealed that a patent false lumen (odds ratio, 3.91; 95% confidence interval, 1.17–13.16; $P = .027$) and excision of the tear (odds ratio, 0.21; 95% confidence interval, 0.06–0.71; $P = .012$) were significant predictors of dilatation of the descending aorta. Two patients in each group developed an aneurysmal change of the residual aorta. In group I, 1 patient required total arch replacement because of rapid expansion of the aorta from 49 mm to 67 mm within 3 months, and 1 underwent descending aortic replacement 3 years after the initial operation. In group II, 1 patient underwent replacement of the descending aorta 1 year after the initial operation, and 1 refused surgery for an aneurysm with a diameter of 61 mm. In group I, 1 patient died of sepsis 32 months after surgery; however, no late deaths occurred in group II.

No difference was found in the freedom from aorta-related clinical events at 4 years (81.9% in group I and 74.4% in group II; Figure 1). Also, no difference was found in the 4-year actuarial survival rate (86.4% in group I and 78.5% in group II; Figure 2).

DISCUSSION

According to our management protocol, the chief priorities of emergency surgery for AAAD are primary excision of the intimal tear and avoidance of serious complications. Several investigators have advocated routine extended or total aortic arch resection for the initial surgical management of AAAD, irrespective of the location of the intimal tear.[6,7] Although they have achieved satisfactory results, it is important to remember that AAAD is a lethal condition, and the first priority is to ensure that the patient lives. If the acute event is not fatal, this constitutes success, regardless of possible later aortic problems. Extended resection will necessarily increase the already-high operative risk. Ehrlich and colleagues[8] reported that the site of the intimal tear did not influence the outcome, although mortality was greater when the resection was more extensive. Bachet and colleagues[9] reported that closure of the entry site at the initial emergency operation led to a lower reoperation rate. Westaby and colleagues[10] also advocated the policy of primary tear excision (ie, the ''conservative pathology-oriented approach''). The only concern is that it remains unclear how extensive the resection should be if no intimal tear can be identified from the ascending aorta to the aortic arch.

TABLE 1. Clinical profile and dissection characteristics

Characteristics	Group I (n = 45)	Group II (n = 57)	*P* value
Clinical			
Age (y)	61.1 ± 12.8	66.7 ± 13.5	.035
Male gender	30 (66.7)	28 (49.1)	.076
Hypertension	31 (68.9)	40 (70.2)	.888
Smoking	4 (8.9)	3 (5.3)	.472
Diabetes	0	1 (1.8)	.372
Dyslipidemia	6 (13.3)	5 (8.8)	.461
Marfan syndrome	0	3 (5.3)	.118
CVD	3 (6.7)	6 (10.5)	.495
IHD	3 (6.7)	5 (8.8)	.695
COPD	1 (2.2)	3 (5.3)	.703
Renal failure	4 (8.9)	4 (7.0)	.727
Dissection			
False lumen thrombosis	25 (5.6)	18 (31.6)	.015
Shock	11 (24.4)	24 (42.1)	.062
Intubation	3 (6.7)	6 (10.5)	.495
CPR	0	3 (5.3)	.118
Moderate to severe AR	3 (6.7)	14 (24.6)	.016
Malperfusion			
Peripheral	4 (8.9)	5 (8.8)	.984
Cerebral	2 (4.4)	1 (1.8)	.425
Cardiac	2 (4.4)	5 (8.8)	.391

AR, Aortic regurgitation; *COPD*, chronic obstructive pulmonary disease; *CPR*, cardiopulmonary resuscitation; *CVD*, cerebrovascular disease; *IHD*, ischemic heart disease.

TABLE 2. Surgical data and early outcome

Variable	Group I (n = 45)	Group II (n = 57)	*P* value
Replacement procedure			<.001
AAR	41	33	
HAR	4	24	
CABG	0	4 (7.0)	.070
Modified Bentall procedure	0	3 (5.3)	.118
AVR	0	1 (1.8)	.372
CPBT (min)	95.5 ± 26.7	121 ± 39.2	<.001
ACCT (min)	54.8 ± 12.6	70.7 ± 22.5	<.001
CAT (min)	21.0 ± 5.4	26.6 ± 10.3	.001
Lowest rectal temperature (°C)	26.6 ± 1.6	25.7 ± 2.4	.025
Complications			
Neurologic deficits	3 (6.7)	5 (8.8)	.695
Pneumonia	3 (6.7)	5 (8.8)	.695
Renal failure	1 (2.2)	2 (3.5)	.703
Mediastinitis	0	1 (1.8)	.372
Prolonged mechanical ventilation (> 24 h)	10 (22.2)	19 (33.3)	.217
Hospital stay (d)	28.3 ± 62.6	21.1 ± 23.2	.422
Operative mortality	3 (6.7)	6 (10.5)	.495
In-hospital mortality	6 (13.3)	7 (12.3)	.874

AAR, Ascending aorta replacement; *ACCT*, aortic crossclamp time; *AVR*, aortic valve replacement; *CABG*, coronary artery bypass grafting; *CAT*, circulatory arrest time; *CPBT*, cardiopulmonary bypass time; *HAR*, hemiarch replacement.

ACD

Fundamentally, the aim of emergency surgery for AAAD is to prevent subsequent complications, such as myocardial infarction, acute aortic regurgitation, and cardiac tamponade, or to relieve existing complications associated with the risk of sudden death. An emergency procedure that involves opening the pericardium and replacement of the ascending aorta or hemiarch replacement is enough to salvage the patient, even if the intimal tear remains in the distal arch or descending aorta. In the present study, the hospital and late mortality rates of both groups were low, and aortic resection for AAAD without excision of the intimal tear was not associated with an increased incidence of reoperation, although nonexclusion of the entry site was an independent risk factor for late aortic dilatation.

Postoperative patency and dilatation of the false lumen are also important issues, which has been emphasized recently by several reports.[11-15] Kimura and colleagues[16] reported that the patent false lumen influenced postoperative aortic enlargement. In the present study, the false lumen was patent in 53.6% of all patients, and no difference was found in the patency rate between the 2 groups. This was considered to be acceptable with reference to previous reports. David and colleagues[17] reported that the prevalence of a patent false lumen after surgery was reduced from 91% to 59% with the open distal anastomosis technique. We believe that emergency open repair and fixation of the distal aortic stump with gelatin resorcin formalin glue decreases the patent false lumen rate and possibly improves the long-term survival of patients with AAAD.[18] No difference was found in the freedom from reoperation on the distal aorta between our 2 groups. Therefore, we consider it is sufficient to repair type A dissection to a level at which it corresponds to type B dissection, even if the intimal tear is not located in the distal aortic arch. It has been reported that the 3-year mortality rate of patients with type B dissection (even with a patent false lumen) is only 10% to 20%.[19,20] We have also reported that the long-term survival rate at 5 and 10 years for patients with type B dissection receiving medical treatment was 89.4% and 71.8%, respectively, regardless of their false lumen status.[21] Therefore, careful observation and management of hypertension are essential for maintaining event-free survival in patients with AAAD in

TABLE 3. Computed tomography findings

Finding	Group I (n = 35)	Group II (n = 34)	*P* value
Aortic diameter			
Initial postoperative CT scan	39.9 ± 5.9	39.2 ± 6.7	.617
Latest CT scan	44.1 ± 8.7	40.6 ± 8.6	.091
Aortic dilatation	3.99 ± 5.3	1.44 ± 4.5	.035
Aortic dilatation > 5 mm	16 (45.7)	5 (14.7)	.005
Maximal aortic diameter > 50 mm	9 (25.7)	5 (14.7)	.256
False lumen thrombosis	14 (40.0)	18 (52.9)	.281

CT, Computed tomography.

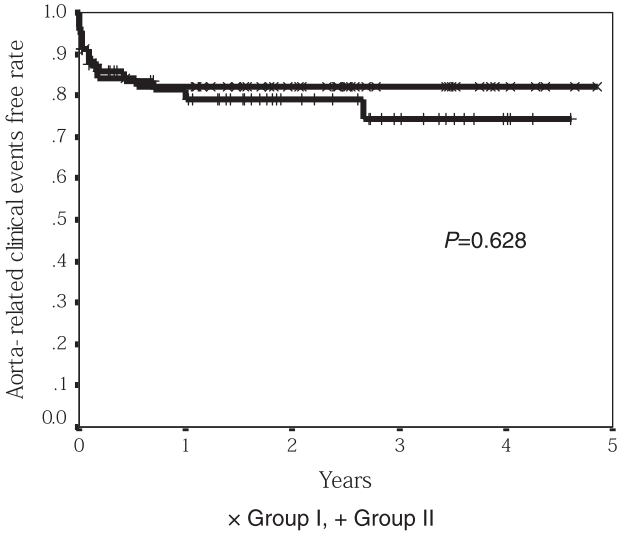

FIGURE 1. Freedom from aorta-related clinical events.

the long term, regardless of whether entry resection has been achieved by the initial emergency surgery.

Study Limitations

The present study had several limitations, including a relatively small number of subjects and a short follow-up period. Moreover, only 69 (77.5%) of the 89 patients discharged from the hospital underwent follow-up CT scanning. In particular, a greater number of patients were lost from group II, and this might have affected the findings from the follow-up CT scanning. No differences were found in the freedom from aorta-related clinical events and survival between the 2 groups, although the aortic diameter of the patients without exclusion of the intimal tear showed significantly more expansion after medium-term follow-up. An assessment of a larger number of patients for a longer follow-up period might have affected the freedom from aorta-related events or survival. Therefore, prospective studies on a larger scale with a longer follow-up period are required.

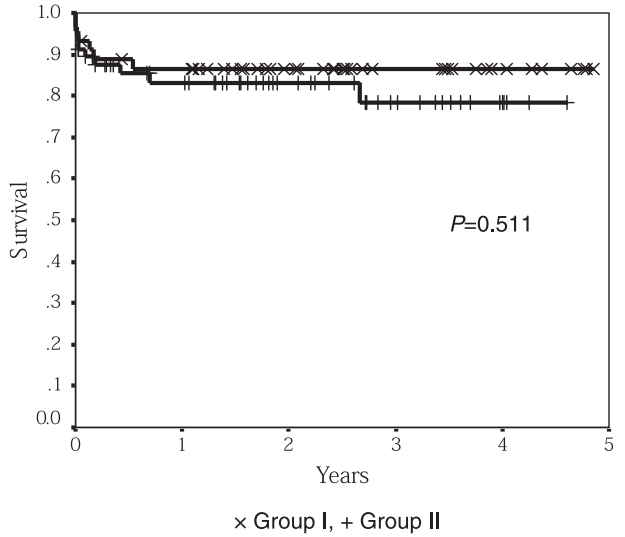

FIGURE 2. Actuarial survival.

CONCLUSIONS

We assessed the medium-term outcomes of surgery for AAAD with an unknown site of entry. The prognosis of patients without exclusion of the intimal tear was acceptable. However, it is important to perform careful follow-up, because a patent false lumen and nonexclusion of the entry are risk factors for aortic dilatation.

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